A study of a population of *Mesoginella pygmaea* (Sowerby, 1846) (Gastropoda: Marginellidae) from the Bay of Islands, New Zealand

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ABSTRACT. The marginellid *Mesoginella pygmaea* (Sowerby, 1846) is presented with reference to its original description and a discussion of the type material. A population of this species encountered during shallow water, small boat dredging operations in the Ohaku Passage, Bay of Islands, Northland, New Zealand, is presented from observations of the living animals and their shells. The variability of the animal is discussed and the radula is demonstrated.

INTRODUCTION

The temperate waters of New Zealand are well known for high marginellid species richness. The majority of species were described in the early to mid 20th Century, many being deep-dredged and described from small lots or single specimens. Powell (1932) provided a review of all of the species known at that time. Ponder (1970) published a detailed anatomical study of three New Zealand endemics, of which one, *Mesoginella pygmaea* (Sowerby, 1846) is discussed herein. Despite these studies, most New Zealand marginellids have yet to be studied in detail. In November 2001, and again a year later, the authors attempted to address this issue by undertaking shallow water dredging operations in one small area of the Bay of Islands in Northeastern New Zealand (Fig. 22). The shallow (3-10 m), narrow tidal passage between the outer islands of Ohaku and Waiwaitorea (Fig. 23) was chosen for its likelihood of being a marginellid-rich site. It was considered that with the open South Pacific beyond, and the large volume of fresh oceanic water passing through this shallow zone, it would be ideal marginellid territory. This indeed proved to be the case, with a total of five species (two *Mesoginella* species, two *Dentimargo*, and one *Gibberula* species) subsequently being recorded. This paper records the extraordinary variety encountered within the population of the most abundant species, *Mesoginella pygmaea*, and is intended to supplement the earlier studies of Ponder and Powell.

The nomenclature of several *Mesoginella* species has led to confusion in the past, and some clarification is required. *Mesoginella pygmaea* is the locally abundant shallow water New Zealand species discussed herein. *Mesoginella pygmaeformis* (Powell, 1937) (Fig. 33) is a smaller New Zealand species with a finely denticulated labrum which occurs in deeper water than *M. pygmaea*. Finally, *M. pygmaeoides* (Singleton, 1937) (Figs 31, 32) is a common South Australian species. This confusion is not helped by Kaicher's (1973) card no. 97 of *M. pygmaea* (as *Granula pygmaea* Sowerby), which actually depicts an example of the South Australian species *M. pygmaeoides*. The type material is discussed below.

Mesoginella is one of four related Antipodean genera described by Laseron (1957) (the others being *Austroginella, Plicaginella and Sinuginella*), all of which share a characteristic radula (Coovert, 1988). It is uniserial, relatively short and broad, with 30-75 slightly arched, overlapping plates bearing 8-21 strong cusps of which the central one is usually the strongest. This radular pattern, clearly present in *M. pygmaea*, was termed 'type 5' by Coovert (1989). The mere fact that these genera are radulate separates them from *Marginella s. str.* and *Glabella* (to which Powell, 1932, referred *M. pygmaea*) both of which lack a radula. The radula of *M. pygmaea* was large enough to be successfully extracted and studied under a compound microscope, for comparison with previous records (Powell, 1932).

Coovert (1988) considered that of these four genera, only *Mesoginella* and *Austroginella* were valid. The axially costate *Plicaginella* was considered to be a synonym of *Mesoginella* since in this group, costae were not considered to be of taxonomic value at the generic level due to their variability. Coovert (1988) considered axial costae more important as a species level character and this proved to be of importance when the type material of *M. pygmaea* was studied by us (see below). In this paper we propose to follow the classification presented by Coovert (1995).

Mesoginella is characterized (after Coovert, 1988) as follows: anterior notch weak to nearly absent; spire low to moderate, with evenly contoured or straight-sided whorls; posterior end of the lip joining the last

adult whorl at, or slightly below, the suture; posterior sinus weak to absent; lip thickest medially, and thickened throughout; last adult whorl obovate; columellar plications occupying up to half the length of the aperture (slightly more in some) with the fourth plication often being remote (further separated than the other three).

In common with most marginellid genera, *Mesoginella* has a 'type 2' animal (Coovert, 1987); the head is simple and unmodified, a pair of long slender tentacles emerging from the anterior end with eyes located at the base of the tentacles on lateral swellings. The siphon is a simple tube formed from a rolled anterior extension of the mantle.

MATERIALS AND METHODS

A rectangular stainless steel dredge with a small mesh size (4 mm) was towed for several minutes at a time behind a small inflatable powered by a 15hp outboard, at 3-10 metres depth. The material obtained was sorted, with the largest pieces of rock and weed being removed by hand. Further coarse fractions were removed using graded sieves. The remaining grit was left to settle for a time in large bowls of seawater with all light excluded. The animals were subsequently collected as they crawled out of the grit and up the sides of the holding vessel. Animals were photographed with a Kodak DCS 760 digital SLR camera, mounted to an Olympus SZX12 stereomicroscope. The radulae were extracted by dissolving the soft parts in a warmed KOH solution, and were mounted on slides for study under an Olympus CX41 compound microscope. Photographs of the radulae were taken with the same camera mounted to this microscope.

ABBREVIATION

BMNH: Natural History Museum, London.

SYSTEMATICS

Family **MARGINELLIDAE** Fleming, 1828
Subfamily **MARGINELLINAE** Fleming, 1828
Tribe **AUSTROGINELLINI** Coovert & Coovert, 1995 ['Austroginella Group']
Genus ***Mesoginella*** Laseron, 1957, type species *Mesoginella turbinata* Sowerby, 1846 (by original designation).
Synonym: *Plicaginella* Laseron, 1957

***Mesoginella pygmaea* (Sowerby, 1846)**
(Figs 1-21, 26-30)

Type material. Holotype, a single adult specimen, 8.6 x 5.1 mm, BMNH No. 1880.9.18.7, ex. coll. Mr. Bell, Locality unknown (Figs. 27, 28).
The holotype was also pictured by Kaicher (1992) on card no. 6194.

Other material examined. New Zealand, Bay of Islands, Ohaku Passage in 3-10 m : several hundred live collected adult and juvenile shells in the collections of the authors, and 15 live collected adult shells, lodged in Museum of New Zealand, Te Papa Tongarewa (the National Museum of New Zealand), Wellington. Adult length 3.8 - 6.4 mm, with most shells in the 4.0 – 6.0 mm range. W:L ratio approx. 63%.

Original Description. 'M. coniformi, laevi, pallidissimè fulva; spira brevi; apertura elongata; columella minute quadriplicata; labio externo laevi, extùs varicose.
Resembling *M. sauliae* in general form, but wanting the coloured lines, and having the outer lip externally varicose. There is also a varix at the anterior part of the body whorl. The specimen is in the collection of Mr. Bell. Locality unknown.'
The original figures (Fig. 26) accurately represent the morphological features of the holotype (Figs. 27, 28).

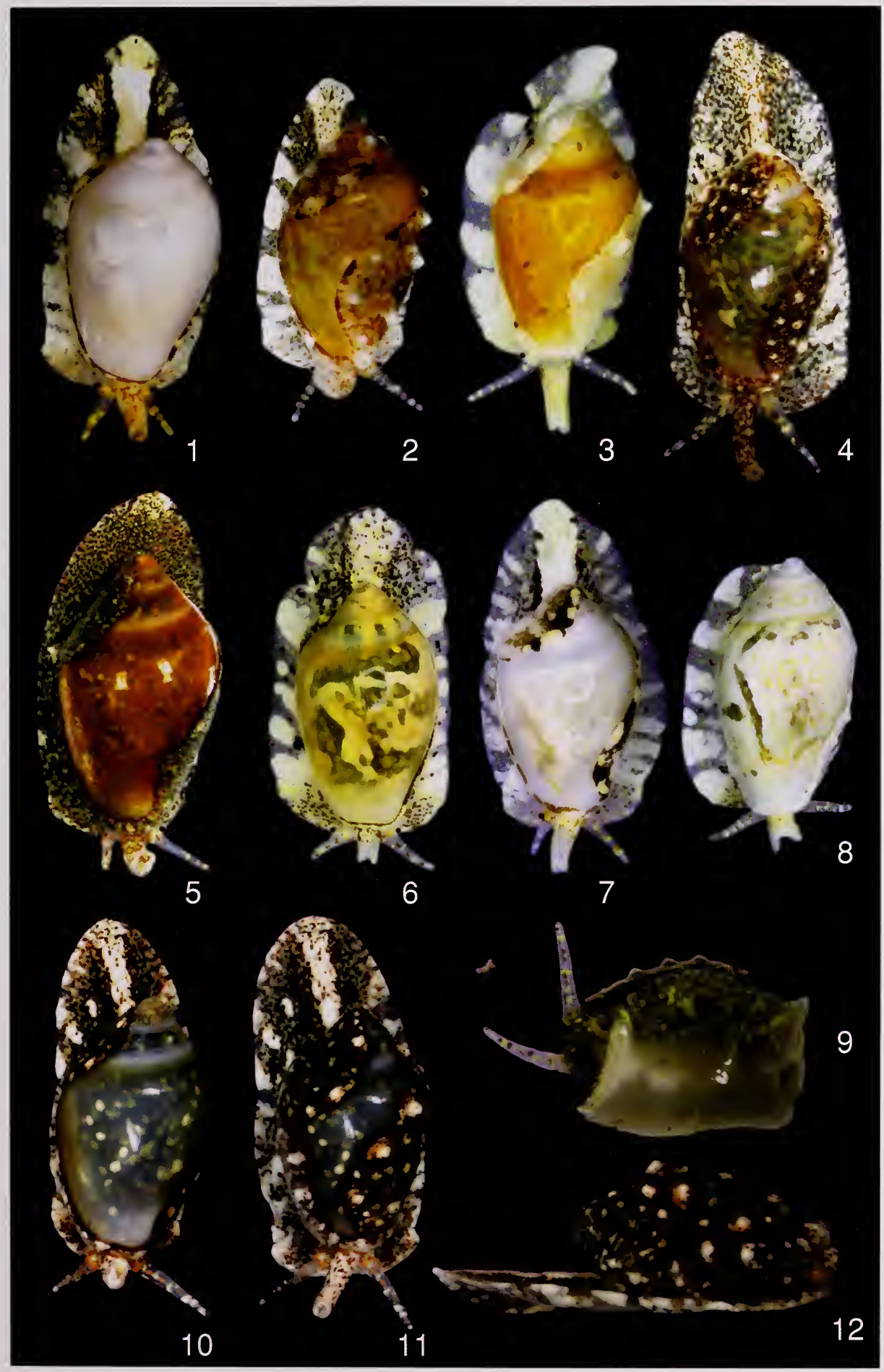
Type locality. Unknown. Proposed as a New Zealand endemic species by Powell (1932).

Habitat. Shallow water (2-10m) on coarse sand/rock rubble/weed substrate, in sheltered areas and tidal channels on exposed coasts.

Distribution. North Island, New Zealand as far south as Wellington. Most abundant on the Northeast coast.

Complementary notes. The description of an adult shell from the Ohaku Passage: Shell small, rounded biconic, smooth, glossy. Shoulder smoothly rounded. Spire elevated (25% of shell length), and slightly convex, of 3.5 whorls including bluntly rounded paucispiral protoconch. Suture smooth. Labrum thickened especially medially. Labial shoulder slightly angular, strongly callused, inserting to level of suture. External varix smoothly formed and moderately strong, extending posteriorly to form labial shoulder and anteriorly around base to columellar area. Labial denticles and parietal lirae absent. Anterior notch absent, posterior notch weak.

Figures 1-12
Mesoginella pygmaea (Sowerby, 1846), Ohaku Passage, Bay of Islands, New Zealand.
1-8. Variation in animal chromatism **9.** View showing lack of colour pattern on ventral surface of foot.
10-12. Sequence of closure of external mantle over shell dorsum.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4 strong, smoothly rounded columellar plications occupying half of apertural length. 4th plication slightly remote from the other three. Aperture as wide as lip medially, widening to 1 ½ times this width posteriorly and at least 2 times this width anteriorly.

Colour translucent pale cream to pale orange brown. Labial callus, columella and suture opaque.

There is a wide variety in adult shell size, with the length ranging from from 3.8 to 6.4 mm, and averaging at 5.0 mm. The shape is rounded biconic, some specimens having more angular shoulders than others. The labrum may be weakly thickened (Fig. 16) or strongly varixed in mature specimens (Fig. 20). The spire may be smooth sided (Fig. 16) or weakly stepped (Fig. 17), and weakly convex (Fig. 14) or occasionally very weakly concave (Fig. 16).

The description of the animals of specimens from the Ohaku Passage: 'Type 2' animal. Tentacles long and slender, translucent with white or pale yellowish and orange or brown spots. Siphon long and slender, opaque cream or yellow, densely mottled with pale orange or brown. External mantle extending asymmetrically over shell in 3 lobes (labial, parietal and spire lobes). Sequence of closure of these lobes over dorsum demonstrated by Figs. 10-12. The parietal lobe, the largest, joins the others close to the external varix of the shell. The mantle is pustulose, but variably so (compare small, evenly sized pustules of Fig. 4 with the large and small pustules of Fig. 11). When the mantle fully covers the shell the sulcus between the mantle and the foot disappears, and the two appear confluent (Fig. 12). The colour of the mantle mirrors that of the foot but is generally a little darker, particularly at the lobe margins. The pustules are generally pale yellow or white. The base colour varies from pale mottled yellowish cream (Fig. 3) through mottled light brown (Fig. 2) to dark brown (Fig. 11). In some specimens the mottling is so profuse as to almost completely obliterate any white markings (Fig. 5). The foot is expansive, about half as long and as wide again as the shell. In most specimens there are large laterally radiating opaque white or creamy white zones, except in those specimens where the dark mottling covers the foot. In between these zones are similarly sized areas of dense small spots of opaque white, cream, yellow orange, pale brown and dark brown. In paler specimens, fewer of the darker of these colours are expressed. The underside of the foot lacks markings except near the edges where the dorsal pattern shows through the translucent tissue (Fig. 9). The internal mantle is also highly variable; from cream and white mottled through finely mottled orange brown, to large clearly mottled white, orange and black. Usually, animals with a darkly coloured, densely patterned foot and mantle have a dark internal mantle, and vice versa. One might expect that the shells with the darkest animals would have the darkest shells. This often occurs but is not always the case, as distinctly orange shells can also be found in very pale animals (Fig. 3).

Ponder (1970) also described and figured the live animal (Fig. 30) and its anatomy in detail.

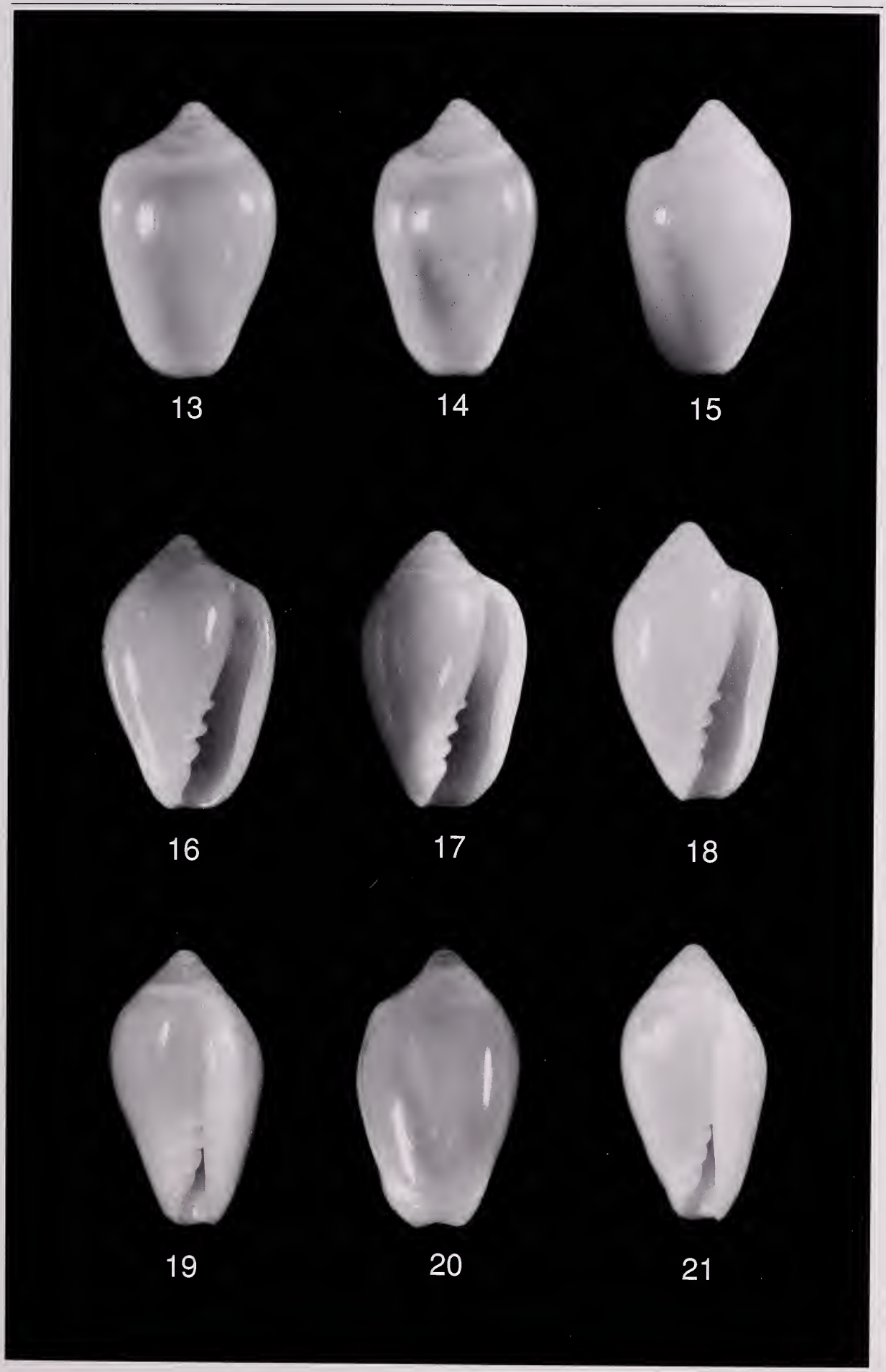
A total of eleven radulae from adult specimens of different sizes were extracted by the second author. This was done primarily to ascertain not only the degree of variability, but also to check the feasibility of the use of radular indices based on variables such as shell height, radular length, total plate count, 'working zone' plate count, cusp count, plate separation and plate width. The radula in Figs. 24, 25 was extracted from an adult specimen (5.9 mm in length) from the Ohaku Passage: it is uniserial, short (1.1 mm), narrow (66 µm), comprising 47 overlapping, slightly convex plates, 12 of which are in the 'working zone'. Base of each plate indented, creating a somewhat chevron-like profile. Indentation also in the base of the very large central cusp. These indentations allow the central cusp of the overlapping plate above to fit in neatly. The cusp count for this radula varied from 11 (Fig. 24) to 15 (Fig. 25). On studying all eleven extracted radulae however, several other details were noted: the cusps appear to be laid down somewhat randomly, and cusp counts on a single side of the large central cusp varies from 4 to 8. A tiny bump may be seen between two cusps, and in succeeding plates this bump can develop into a minute cusp. From there it might develop into a full sized cusp or diminish and disappear again. Some cusps bifurcate at their tip, and this division develops on succeeding cusps until there may be two individual full sized cusps. There may also be other variations. It was noted that plates in the 'working zone' often are damaged and have cusps broken off.

Powell (1932) illustrated the radular plate of this species, and noted the indentation in the basal plate, and the extremely long and narrow central cusp. Ponder (1970) noted that in addition to the prominent central cusp, the short lateral cusps numbered 6 or 7 on each side.

Figures 13-21

Mesoginella pygmaea (Sowerby, 1846), Ohaku Passage, Bay of Islands, New Zealand.

13. 5.92 x 3.78 mm; **14.** 5.88 x 3.58 mm; **15.** 5.84 x 3.45 mm; **16.** 5.92 x 3.78 mm; **17.** 5.88 x 3.58 mm; **18.** 5.84 x 3.45 mm; **19.** 5.92 x 3.78 mm; **20.** 5.42 x 3.19 mm; **21.** 5.84 x 3.45 mm.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DISCUSSION

Figs 1-12 demonstrate completely intergrading forms from densely spotted animals with little in the way of a radial pattern to those with very few spots and many radiating white zones. No trends in radular morphology, shell size and shell shape in relation to the colour and pattern of the animal were found. Whilst it is possible that these forms might represent different sibling species, it seems more likely that they are conspecific. If this is the case it is clear that it can be unwise to attach too much importance to any single character for the purposes of identification of at least some of the members of this genus.

A review of the available type material was considered necessary to complete this study since Powell (1932) did not refer directly to the original figure, nor to the type material in his work. Indeed he invited others to compare the type material with his own line drawings of *M. pygmaea* from New Zealand and of a related Tasmanian species that he referred to as *M. aff. pygmaea.*

The original figure of *M. pygmaea* (Fig. 26) presented by Sowerby in his *Marginella* monograph (1846) is without doubt the holotype (Figs. 27-29) in the BMNH collection. The scale bar adjacent to the original figure is the same length as that of the type specimen, and the morphology of the type specimen is a close match with its figure (compare Fig. 26 with Figs 27, 28). What is not evident from the dorsal and ventral views of the original illustration and description, however, are the 5 very weak and evenly spaced axial costae present on the dorsal aspect of the last adult whorl (Fig. 29). All of the three hundred or so Northeast New Zealand specimens from the Bay of Islands collected and studied by the authors have a perfectly smooth last adult whorl and completely lack axial costae. In addition no specimen exceeds a length of 6.4 mm. Powell (1932) and Ponder (1970) gave similar size ranges for this species of 6.0 – 7.0 mm and 5.5 – 6.0 mm respectively. With the holotype measuring 8.6 mm, further discrepancy is evident. However, apart from this size difference, and the presence of the 5 weak axial costae, the morphology of the type is similar to *M. pygmaea*, with its high labial varix and the 4 widely spaced plications (the 4th being slightly remote from the preceeding 3 and situated in the mid-apertural position). The type specimen of *M. pygmaea* can also be said to be close to the type specimen of the South Australian *M. inconspicua* Sowerby (BMNH No. 80.9.18.8), but the former is wider at the shoulder.

Shell size and shape is variable within the Bay of Islands population. The presence of axial costae in other marginellid groups e.g. *Glabella* is of diagnostic significance at the generic level, but in *Mesoginella* it tends to be a very variable character, and in this genus neither size nor the amount of axial costation are reliable indicators for species identification purposes (Coovert 1988). For example, the lot of 8 syntypes of the type species of the genus, the Australian *M. turbinata* (Sowerby, 1846) in the BMNH, vary from smooth shelled to heavily costate. What is clear though is that the type specimen of *M. pygmaea* is not particularly representative of the studied population and therefore it is probable that the New Zealand species which has been long established as *M. pygmaea* is in fact undescribed. The authors understand that this issue is currently being addressed by Dr. Bruce Marshall of the Museum of New Zealand, Te Papa Tongarewa, Wellington (paper in press).

Powells (1932) specimen figured as *M. aff. pygmaea* from Tasmania, is likely to be *M. pygmaeoides* (compare Fig. 31 with Fig. 32).

Populational studies such as the present one can potentially reveal sympatric sibling species. For example, within the samples of *M. pygmaea* from the Bay of Islands the second author has discovered another *Mesoginella* species (tentatively identified as *Mesoginella tryphenensis* Powell, 1932) which exhibits constant yet subtle differences from *M. pygmaea* in the chromatism of the animal, and the morphology of the shell.

Mesoginella pygmaea is, quite possibly the most variable marginellid species encountered and studied by the authors to date. The chromatism of the animal, shell size, and to a lesser extent the shell shape and colour are all very variable and it will be interesting to see if this variety is replicated in other *Mesoginella* species and is thus established as a characteristic of the genus.

Figures 22-33

22. Map of the Bay of Islands, Northland, New Zealand; **23.** Topography of the sampling site; **24.** Radular ribbon of *M. pygmaea*, width 66µm, 11 cusps per plate; **25.** Individual radular plates of *M. pygmaea*, 15 cusps per plate; **26.** Original figures of *M. pygmaea* from Sowerby's *Marginella* Monograph (1846); **27-29.** *M. pygmaea*, holotype, 8.6 x 5.1mm (BMNH No. 1880.9.18.7); **30.** *M. pygmaea*, drawing of live animal from Ponder (1970); **31.** *M. aff. pygmaea*, Tasmania, from Powell (1932); **32.** *M. pygmaeoides* (Singleton, 1937), Cat Bay, Phillip Is., Victoria, Australia. 6mm; **33.** *M. pygmaeiformis* (Powell, 1937), off Three Kings Is, New Zealand, 260m, holotype, 4.8 x 3.2mm (BMNH No. 1961.21063).

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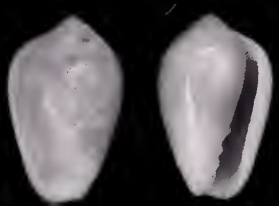

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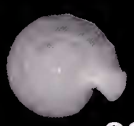

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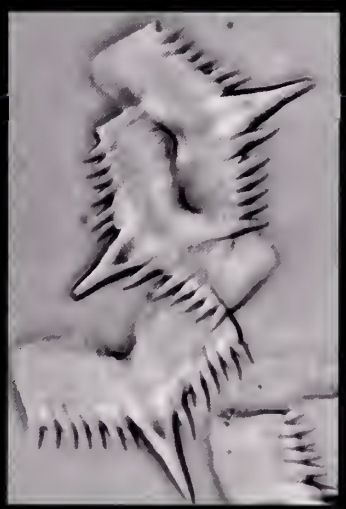

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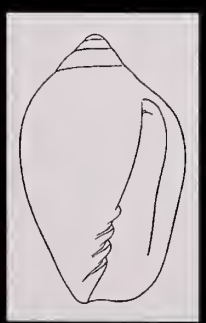

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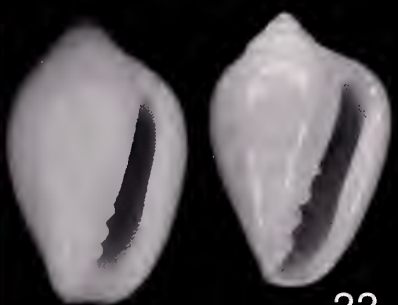

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It is generally accepted that the marginellid radula is usually of use as a diagnostic indicator at generic level only. The relative length of the long central cusp in the radula of *M. pygmaea* may, however, prove to be diagnostic at the species level. The diagnostic value of various radular indices at the generic and species level for this and other *Mesoginella* species is currently being determined by the second author.

Coovert (1988) has shown that the Australian *M. turbinata* and *M. inconspicua* have short central cusps when compared to that of *M. pygmaea.* Whether this represents a constant difference between Australian and New Zealand *Mesoginella*, thereby indicating the presence of sub-groups within this genus, will only become apparent with further comparative radular studies.

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